AD-A121 919 ELASTIC STABILITY(U) CALIFORNIA UNIV BERKELEY 1/1
J E MARSDEN NOV 82 ARO-16567.19-MA DAAG29-79-C-0086

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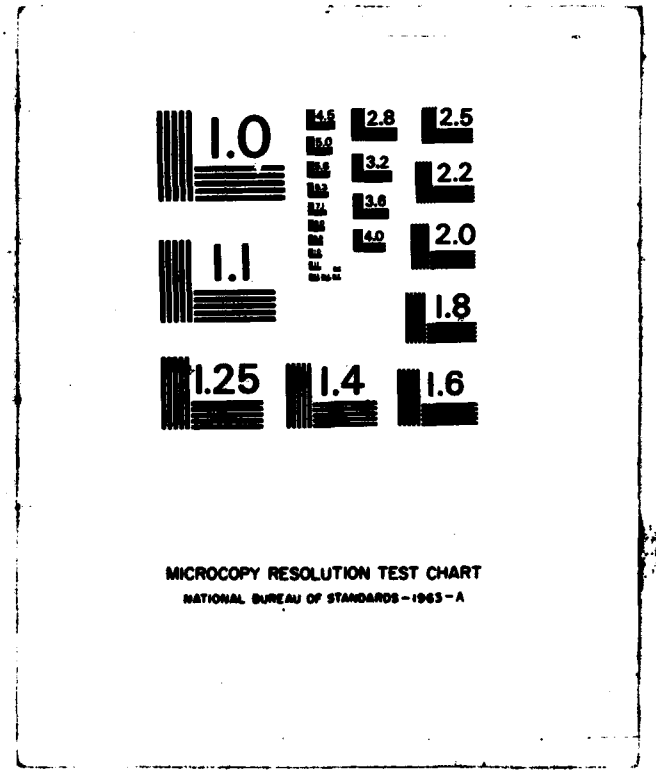
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

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REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER: 16567.19-MA	2. GOVT ACCESSION NO.: AD-A121919
3. RECIPIENT'S CATALOG NUMBER:	
4. TITLE (and Subtitle): Elastic Stability	5. TYPE OF REPORT & PERIOD COVERED: Final: 1 May 79 - 31 Aug 82
	6. PERFORMING ORG. REPORT NUMBER:
7. AUTHOR(s): Jerrold E. Marsden	8. CONTRACT OR GRANT NUMBER(s): DAAG29 79 C 0086
9. PERFORMING ORGANIZATION NAME AND ADDRESS: University of California, Berkeley, CA 94720	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS:
11. CONTROLLING OFFICE NAME AND ADDRESS: U. S. Army Research Office, Post Office Box 12211, Research Triangle Park, NC 27709	12. REPORT DATE: Nov 82
	13. NUMBER OF PAGES: 4
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

NA

18. SUPPLEMENTARY NOTES

The view, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

plasmas (physics)
stability
elasticity
traction
magnetohydrodynamics
thin shells
buckling

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A bibliography of recent publications is given.

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FINAL REPORT

PERIOD COVERED BY REPORT: May 1, 1979 - August 31, 1982

TITLE OF PROPOSAL: Elastic Stability

CONTRACT OR GRANT NUMBER: DAAG - 29 - 79 - C - 0086

NAME OF INSTITUTION: University of California, Berkeley

AUTHOR(S) OF REPORT: Jerrold E. Marsden, P.I.

SCIENTIFIC PERSONNEL SUPPORTED BY THIS PROJECT AND DEGREES AWARDED DURING THIS REPORTING PERIOD:

Research Associates: T. Ratiu (Ph.d. 1980), D. Bao, J. Pierce, R. Wohl.

Visiting Professors:
1. J. Ball (Edinburgh) May 1979 - April 1980
2. P. Holmes (Theoretical and Applied Mechanics, Cornell) January - June, 1981
3. M. Golubitsky (Arizona) January 1982 - June, 1982.

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FINAL REPORT

The following projects were completed.

1) Work on the number and stability of solutions of the traction and related problems in elasticity with D. Chillingworth and Y.H. Wan in a series of four papers was continued. One paper is about to appear, two are in refereeing and the last is in preparation.

2) Work is underway concerning the Hamiltonian structure of the plasma, MHD and related equations with applications to stability, jointly with A. Weinstein. Several outstanding problems were solved by combining geometric and analytic techniques (see the references attached).

3) During Golubitsky's visit on the contract, papers on the Morse lemma and the buckling of shells were completed. This visit inspired an extension of the work of Holmes and Marsden from the previous year. Using singularity theory they now believe they can extend their results on chaos to weakly coupled oscillators. This would answer very important questions about KAM theory and interacting wave models.

Recent Publications

1. Bifurcations of momentum maps (with J. Arms and V. Moncrief), Comm. Math. Phys. 78 (1981), 455-478.

2. Lectures on geometric methods in mathematical physics, CBMS-NSF Regional Conference Series in Applied Mathematics, #37, SIAM (1981), 97 pp.

3. A partial differential equation with infinitely many periodic orbits: Chaotic oscillations of a forced beam (with P. Homes), Arch. Rat. Mech. An. 76 (1981), 135-167.

4. Four applications of nonlinear analysis to physics and engineering, in "New Directions in Applied Mathematics," D. Hilton and G. Young, eds. (1981), 85-107.

5. Horseshoes in perturbations of Hamiltonian systems with two degrees of freedom (with P. Holmes), Comm. Math. Phys. 82 (1982), 523-544.

6. Symmetry and spaces of solutions of relativistic field theory with constraints, Springer Lecture Notes 905 (1982), 29-44.

7. The Hamiltonian structure of the Maxwell-Vlasov equations (with A. Weinstein), Physica D 4 (1982), 394-406.

8. Melnikov's method and Arnold diffusion for perturbations of integrable Hamiltonian systems (with P.J. Holmes), J. Math. Phys. 23 (1982), 669-675.

9. A group theoretic approach to the equations of plasma physics, Can. Math. Bull. 25 (1982), 129-142.

10. Control of distributed bilinear systems (with J.M. Ball and M. Slemrod), SIAM J. Control and Optim. 20 (1982), 575-597.

Papers in Production

(Journal to appear, where known)

1. The initial value problem and the dynamics of gravitational fields, Proc. GR9 (Accepted: Springer Lecture Notes).

2. Symmetry and bifurcations in three dimensional elasticity, I (with D. Chillingworth and Y.H. Wan) (Accepted: Arch. for Rat. Mech.).

3. Horsehoes and Arnold diffusion for Hamiltonian systems on Lie Groups (with P.J. Holmes) (Accepted: Indiana University Math. J.).

4. Applications of the blowing up construction and algebraic geometry to bifurcation problems (with M. Buchner and S. Schecter). (Accepted: J. Diff. Equations).

5. A slice theorem for the space of solutions of Einstein's equations (with J. Isenberg) (Accepted: Physics Reports).

6. Constraints and momentum maps for relativistic classical fields (with Sniatycki, Gotay, Isenberg and Yasskin) (In preparation).

7. The Morse lemma in infinite dimensions via singularity (with M. Golubitsky) (Accepted: SIAM J. Math. An.).

8. Examples for the Morse lemma in infinite dimensions (with M. Buchner and S. Schecter) (Accepted: SIAM J. Math. An.).

9. The structure of the space of solutions of Einstein's equations, II (with J. Arms and V. Moncreif) (Accepted: Ann. of Phys.).

10. Coadjoint orbits, vortices, and Clebsch variables for incompressible fluids (with A. Weinstein) (Accepted: Physica D).

11. Semi-direct products and reduction in mechanics (with R. Ratiu and A. Weinstein) (Preprint).

12. Bifurcation problems with hidden symmetries and applications to shell buckling (with M. Golubitsky and D. Schaeffer) (Preprint).